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G21B 1/00

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G6P P3E4X

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None

(58) Field of search
UK CL (Edition K) G6P
INT CL[5] G21B

(54) A method and apparatus for the controlled initiation of nuclear reactions

(57) In a method for producing a nuclear reaction or a nuclear fusion the fusion medium consists of deuterium-containing, non-crystallized polymer, which is conditioned with incident electromagnetic waves for a prolonged period of time, the incident frequency being selected as the tunnel eigenfrequencies of the non-conditioned medium. This leads to operation as a fusion battery, consisting of a metallic container (1) and an electrode (2) of the same metal which is placed centrally and coaxially in the container (1) and with the fusion medium (3) therebetween. A means (5) for receiving current produced is arranged outside the container and connected electrically to the container (1) and the electrode (2).

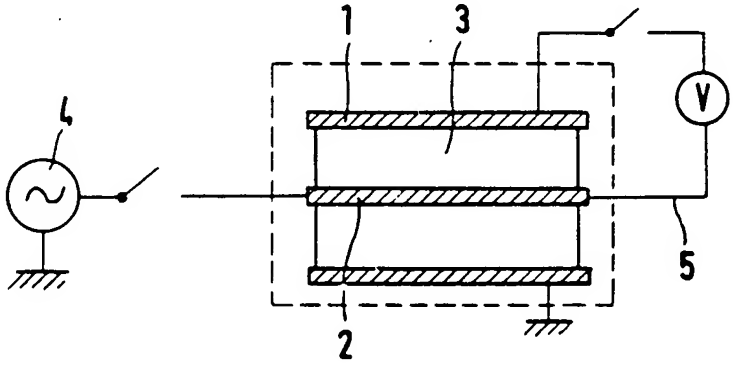


Fig.1.

GB 2 237 139 A

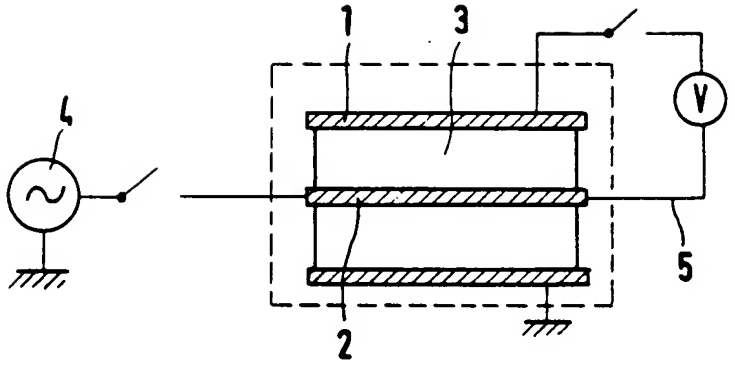


Fig.1.

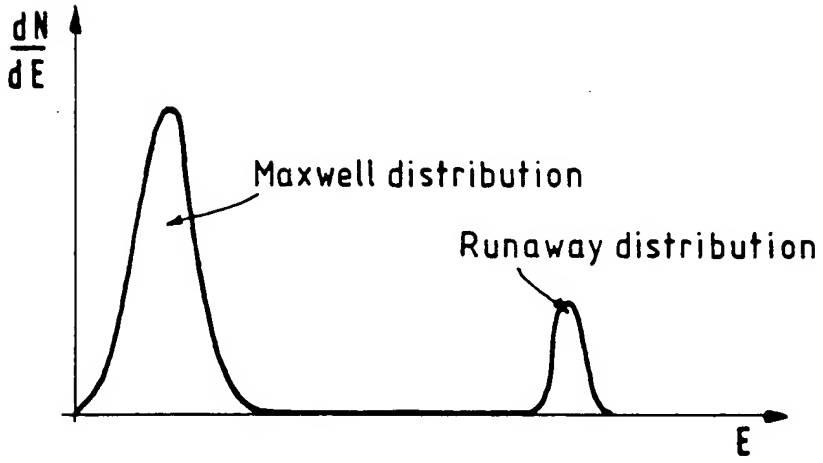
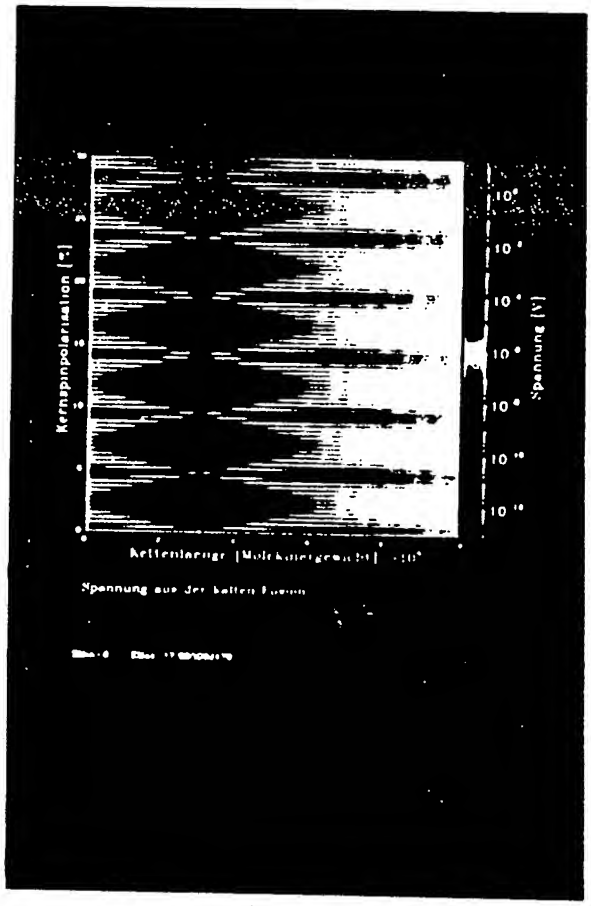


Fig.2.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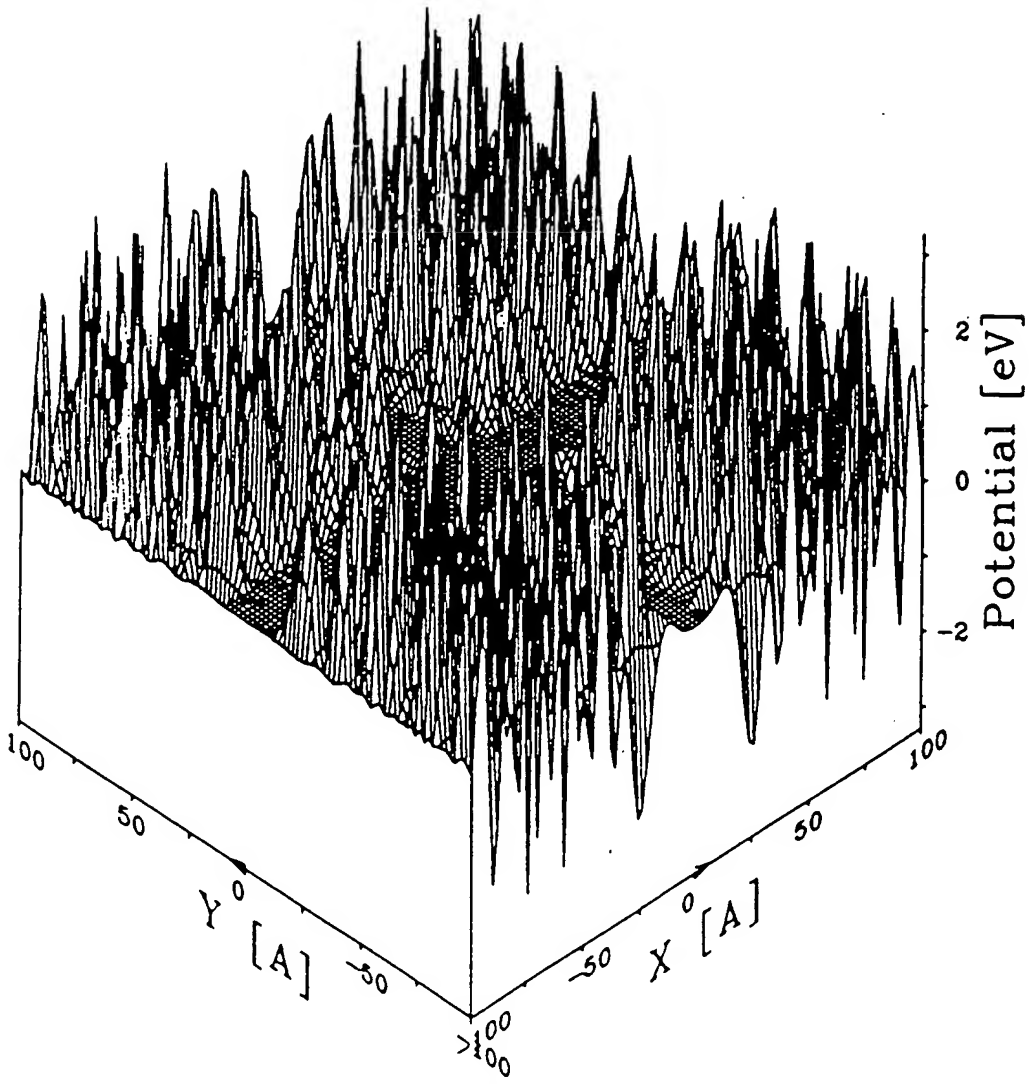
Kettenlänge [Molekulargewicht]
Spannung [V]
Spannung aus der kalten Fusion

Fig.3.

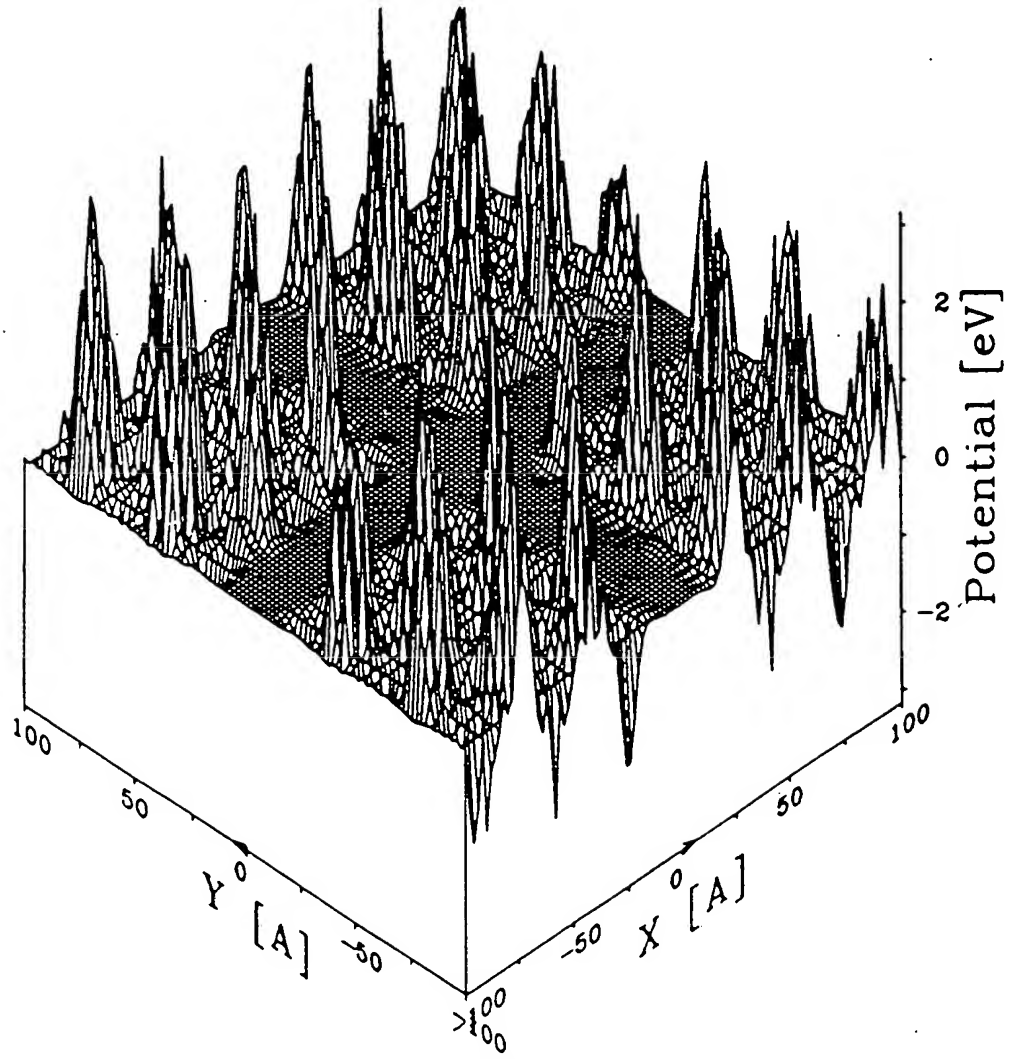


Quantum mechanical Potential of the
Outer surface of the Polymer
n=1, 40 MHz

1989-07-19
10:34:38
HGS(HOS/VE)
W. Eberl

ZMin=-3.281887440231 ZMax=3.281887440231

Fig. 4.



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n=2, 35 MHz

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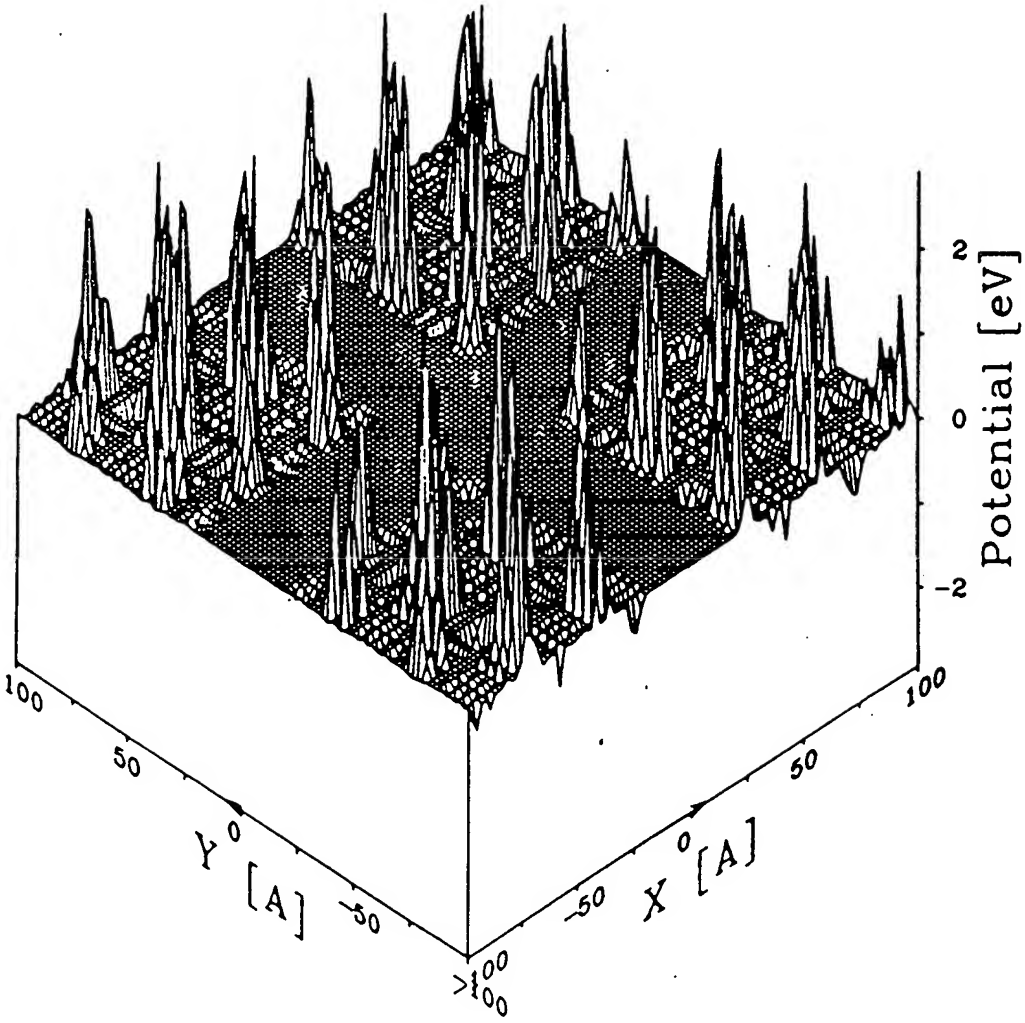
BGS(NOS/VE)
W. Eberl

ZMin=-3.169066730534 ZMax=3.169066730536

Fig.5.



Quantum mechanical Potential of the
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n=8, 36.5 MHz, T=1 Hours

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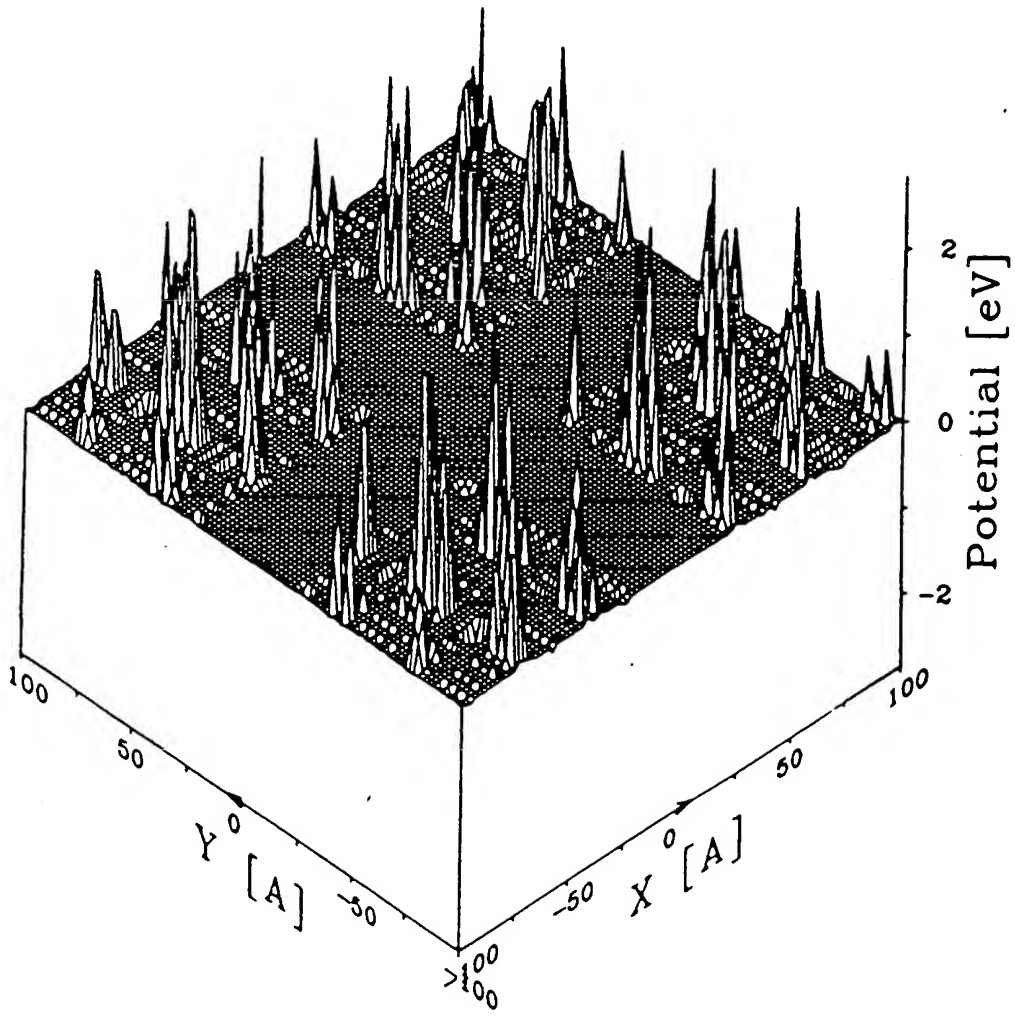
W. Eberl

ZMin=-2.922751048074 ZMax=2.922751048076

Fig.6.



Quantum mechanical Potential of the
Outer surface of the Polymer
n=16, 36.5 MHz, T=10.4 Hours

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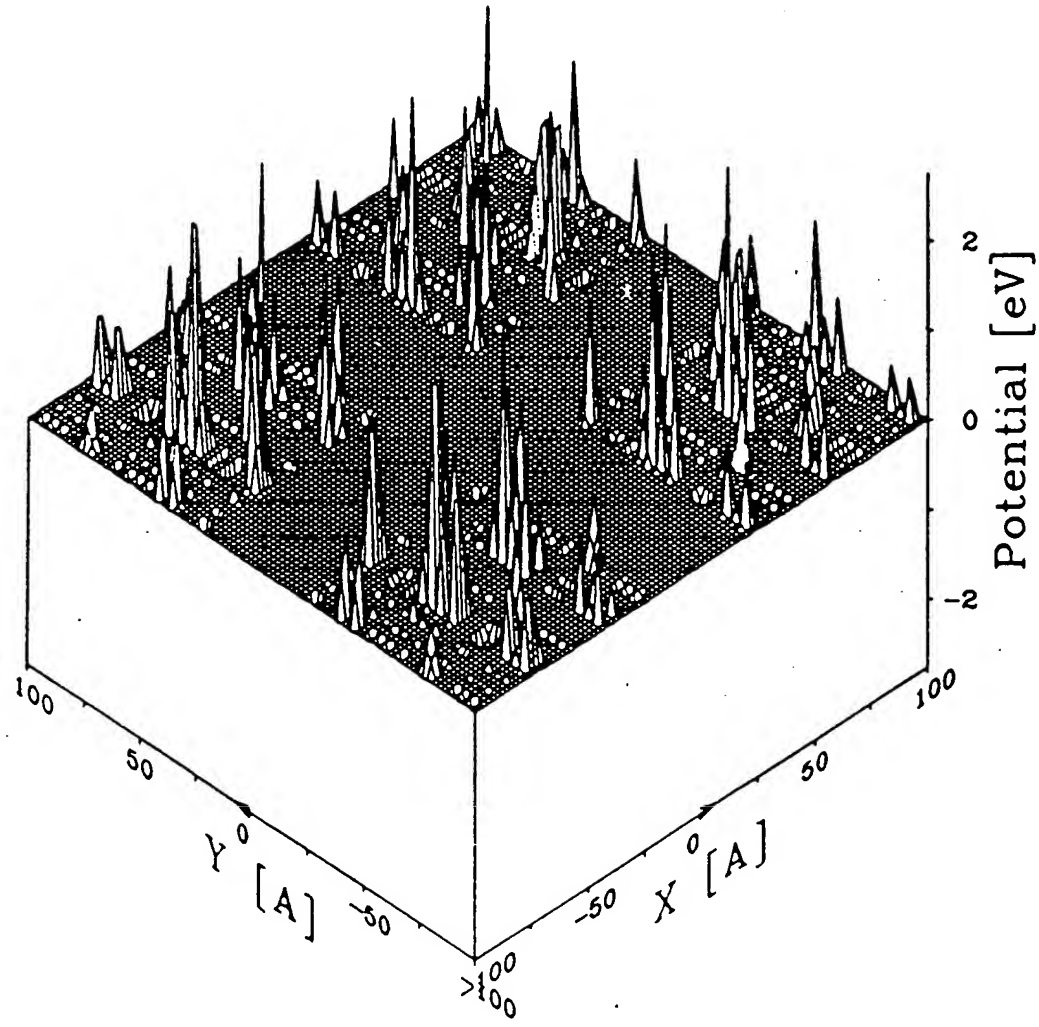
HGS(HGS/VE)
W. Eberl

ZMin=-2.840608472157 ZMax=2.840608472161

Fig.7.



Quantum mechanical Potential of the
Outer surface of the Polymer
n=24, 36.5 MHz, T=19.1 Hours

1989-07-19
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W. Eberl

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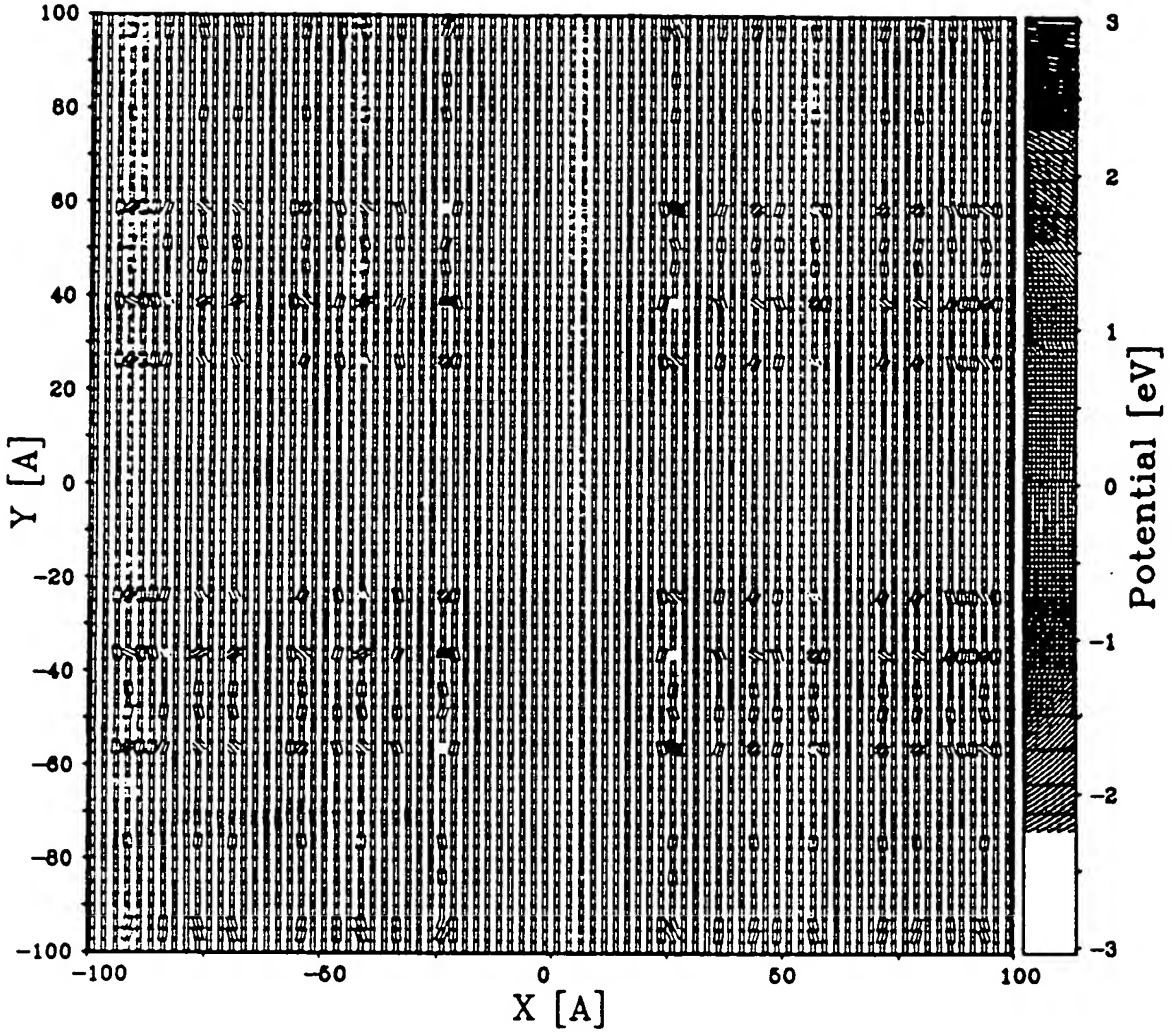
Fig.8.



Quantum mechanical Potential of the
Outer surface of the Polymer
n=24, 36.5 MHz, T=19.1 Hours

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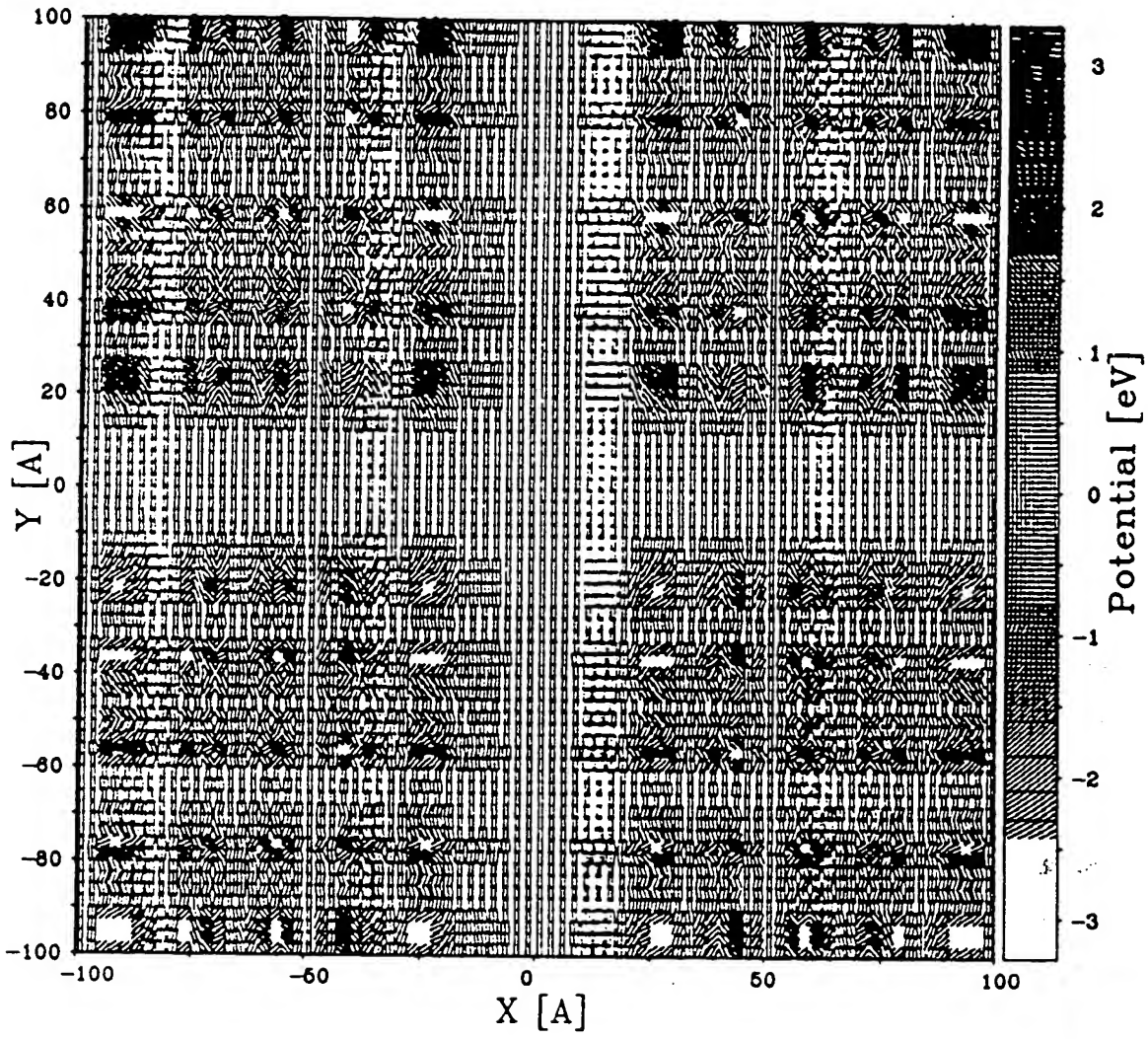
HP3(NOS/VE)
V. Eberl

ZMin=-3.032298365984 ZMax=3.032298365983

Fig.9.



Quantum mechanical Potential of the
Outer surface of the Polymer
n=1, 40 MHz

1989-07-19
10:36:16
EGS(KOS/VE)
W. Eberl

ZMin=-3.277772188177 ZMax=3.277772188177

Fig.10.

A Method and Apparatus for the controlled Initiation of nuclear Reactions-

The invention relates to a method for producing nuclear reactions or nuclear fusion employing the tunnel effect and to apparatus for performing the method.

For many decades the commercial utilization of nuclear fusion has been the objective of numerous research teams, with the general aim of starting physical processes of the type which have been taking place for hundreds of thousands of years on the sun. In such processes there is a hot fusion of hydrogen nuclei at many hundred million degree to form helium with the release of huge forces. This technology is such that at a hundred million degrees C myriads of hydrogen atoms - entrapped in invisible magnetic cages, whose fields of force hold the incandescent gas in the form of a cloud to keep it away from and prevent it from melting the steel walls of the fusion reactor - are fused to helium nuclei. However, this fusion apparatus still consumes substantially more energy than the energy released by the fusion of the atomic nuclei taking place within it.

An alternative challenge is represented by cold nuclear fusion, that is to say the fusion of hydrogen atoms to yield helium atoms in a test-tube at room temperature with the current of a battery. In this respect there is more particularly the work of the physicists Pons and Fleischmann with their claim to have performed a laboratory experiment with simple apparatus amounting to a furth r step on th way towards nuclear fusion.

Th exp rimental setup and the method of Pons and

Fleischmann was based on the following: two electrodes were arranged in a vessel of which on in the form of palladium was th cathod and the other in the form of platinum was the anode. Heavy water, deuterium oxide (D_2O), was introduced into the vessel and the electrodes were connected with an electrical battery. If now the two poles are held in the heavy water and are connected with the current, electrolysis will take place: The electric potential between the anode and the cathode cleaves the molecules of the heavy water into their electrically charged components, which are then attracted by the plus and, respectively, minus poles. The oxygen collects at the platinum rod while the deuterium is attracted to the palladium electrode. Electrically attracted, the deuterium makes its way into the atomic lattice of the palladium where it accumulates. More and more atomic nuclei join in and they are compacted together as if they were acted upon by huge pressures. As a result it is possible for their natural repulsive forces to be overcome and deuterium nuclei fuse as helium nuclei or nuclei of superheavy water (tritium) while at the same time releasing immense quantities of energy. Therefore this method is assumed to produce harmful radiation.

Another method for performing cold fusion has been known for a number of years, that is to say muon nuclear fusion. In this case electrically charged atoms were fired at carbon at nearly the speed of light using a particle accelerator. A beam of muons was formed which was then deflected by the scientists into a compacted mixture, located in a pressure vessel, of the hydrogen isotopes deuterium and tritium, the muons being able to pass unhindered through the walls of the vessel. The atoms of the mixture catch muons, which now occupy the site of the original electron, and orbit around the nucleus of the hydrogen atoms in the shell. As a result the physico-chemical situation radically changed: a muon is 207 times heavier than an electron. The consequence is that muons move along a very much tighter orbit. The new structure is termed a mesonatom. If a tritium mesonatom collides with a normal

deuterium atom, the muon will go into an orbit around both of th nuclei as if it were tying them togeth r. The result f this forced coupling is a nuclear fusion. As soon as the process is completed, the muon goes on to another pair which it couples together as a catalyst. The fugitive muon does however not create enough effective unions in order to start a sort of chain reaction; it decays too quickly. Therefore it is not even possible to produce enough energy as would be required for the particle accelerator, which has to produce a sufficient number of muons.

The form of cold fusion - whatever the precise events in it may have been - claimed by Pons and Fleischmann does not presently appear to be commercially promising either. It suffers from the disadvantage that it either only produces a reasonable output for a short time or only produces a minute output for a prolonged period. Owing to irregular conditions it was often impossible to repeat the experiments. Furthermore the danger due to radioactive products has to be particularly noted. Palladium, the most important component in the Pons and Fleischmann nuclear fusion is a very rarely occurring and thus expensive noble metal.

Accordingly one object of the present invention is to make possible continuous cold nuclear fusion with a commercially significant net production of energy.

A further aim of the invention is exclude the occurrence of radioactive products.

Yet another objective of the invention is to provide such a method in which at least a major part of the energy produced is directly available as electrical energy.

In order to achieve these or other objects appearing from the present specification, claims and drawings, in the present invention the fusion medium consists of a deuterium containing, noncrystallized polymer, which is conditioned by causing electromagnetic waves to be incident thereon for a long period of time, the incident frequency being selected as the tunnel eigenfrequencies of the unconditioned medium. The fusion medium

may be a d ut rium-containing silicone or deuterium-containing polyamino acids. The fusion m dium should hav a high fraction of hydrog n bridges with doubl and multiple minimum pot ntials and the degree of polymerization (more particularly chain length) should be so set that the phonon turbulence reaches a maximum at a finely tuned nuclear spin polarization in order to produce wide tunneling lanes. The fusion material should be so selected on the basis of systematic calculations that it permits a very dense addition of deuterium atoms in its crystal lattice and there is an optimum condition for the fusion of deuterium atoms to form helium ones. The second criterion is the selection of the tunnel eigenfrequency of the medium as the incident frequency for the electromagnetic waves. It is in this manner that the repulsive forces of the protons in the deuterium atom are further reduced in order to facilitate fusion to form a helium atom. The invention contemplates the use of the following reactions

$$D + D \longrightarrow {}^4He + n\Gamma \qquad (1)$$

$$D + H \longrightarrow {}^3He + \gamma \qquad (2)$$

In addition to their effectiveness these reactions have the added advantage that their products are not radioactive.

Thus one aim of the invention was to not make any use of radioactive tritium in accordance with the reactions:

$$D + {}^3H \longrightarrow {}^4He + n$$

$$^5Li + {}^3H \longrightarrow {}^6Li + D$$

The reactions accompanying reaction (1)

$$D + D \longrightarrow {}^3He + n$$

$$D + D \longrightarrow {}^3H + n$$

with their radioactive products n and ^3H are suppressed in the instant invention, for the radioactive products have the long term effect of degrading the medium, in which the resonant tunnel effect takes place.

The difficulties which obstructed the long road to cold fusion reaction were essentially in connection with the following:

- The modelling and computation of large molecular agglomerates:
- the influence of the marginal material on the nuclear spin polarisation;
- computation of the maximum fusion cross sections as a function of the mean impact energy;
- nuclear spin polarization and tunnelling rate;
- maximization of the tunnelling rate;
- selection of a suitable material for nuclear fusion to take place in.

In order to increase the electrical efficiency, and to reduce the heat energy which occurs, so-called moderators may be introduced, which are added to the unconditioned polymer. In this way nuclear reactions which take place in the manner of a cascade are suppressed. The cascade reactions which are difficult to control convert the fusion energy almost exclusively into heat, with partly undesired spontaneous energy release. In a majority of technical applications for cold nuclear fusions, however, the electrical energy obtained therefrom can be used directly, for example as driving energy for motor vehicles. Since the moderators sharply accentuate the nuclear reaction activation cross-sections for the electromagnetic waves in the range of from 35 to 40 MHz, the number of the nuclear reactions initiated in a controlled manner substantially increases and therefore also the electrical efficiency. nickel salts, such as for example Ni $(CH_3COO)_2$;

$NiSO_4$, may be used as moderators.

The concentration of the moderators lies preferably in the operating optimum of between 0.1 and 1.5% by weight.

The moderators ensure a more effective link between the electromagnetic and the strong interaction.

Further features and advantages of the invention will be gathered from the ensuing detailed description of several embodiments thereof referring to the drawings.

Figure 1 is a diagrammatic view of a nuclear fusion battery.

Figure 2 is a graph of curves to indicate Maxwell and runaway distribution.

Figure 3 is a diagram of nuclear spin polarization as plotted again chain length.

Figures 4 to 10 are diagrams of quantum mechanical potentials.

The apparatus (Figure 1) for the performance of the method in accordance with the invention consists of a coaxial and central arrangement including a container 1 and an electrode 2. Between them the medium 3 is arranged. This medium forms the site where the fusion reactions are induced. An RF generator 4 is provided for the supply of electromagnetic waves in the fusion medium 3. The fusion product is removed directly in the form of electrical energy via a circuit 5 placed between the container 1 and the electrode 2. The fusion battery in the strict sense of the term is situated in the rectangle marked in broken lines. The important features for the design of the fusion battery are the dimensions, the selection of thematerial for the outer wall and the electrodes

and also the m dium.

High transmission rates (a high impact rate and thus a high fusion rate) are attained if the so-called runaway effect is utilized. The runaway effect is understood to be a thermodynamic condition, which not only involves the Maxwell energy distribution but also a second distribution curve with substantially higher energies (see figure 2).

In order to achieve a statistically significant runaway distribution in liquid and solid media, the phonons have to be brought into a turbulent state.

The method in accordance with the invention in order to achieve a high phonon turbulence is based on the conversion of electromagnetic energy into phonon turbulence by way of the reaction

$$h\nu \rightarrow n\Gamma$$

The energy of the electromagnetic wave $h\nu$ is converted in the medium into n phonons. However in order for the phonons to be converted into a highly turbulent state and in part to bring other optical phonons, which are already present, into the highly turbulent state, the electromagnetic wave has to have to following properties:

- the frequency of the wave has to be between 35 and 40 MHz or between 70 and 75 MHz (dependent on the fusion medium).
- the perturbation or spurious frequency deviation has to be less than 10 Hz. The phase of the incident waves should remain constant as long as possible.

The wavelength of the phonons with the maximum degree of turbulence is about 53 mm and thus determines the diameter of the fusion battery.

The length of the battery is in accordance with the following formula: $((2n+1)/4)\ \lambda$, (wherein n = 0, 1, 2...) of the wavelength of the electromagnetic radiation in the fusion medium.

The long range correlations between the protons and, respectively, th d uterons in th hydrogen bridges of the fusion

medium lead to a mutual influ nc of th nuclear spin.

Sinc th correlation extends as far as th wall of the vess l, th material of which the vessel is made plays an import part. The electron spin alignment of the wall material and the charge density fluctuation determine the nuclear spin alignment (nuclear spin polarization) of the medium. Since the nuclear spin polarization has a predominant influence on the impact cross sections in fusion reactions, the material of the vessel also influences the fusion rate.

Figure 3 shows the fusion rate for a given fusion medium (polyamino acid) as a function of the chain length of the medium and the nuclear spin polarization. It is clear that for certain values of the nuclear spin polarization there is a large amount of freedom as regards chain length. Greater freedom of chain length means that the production of the optimum fusion medium may be substantially simplified and/or cheapened. Furthermore the sensitivity of the fusion battery with respect to interference is considerably reduced. On the basis of the desired nuclear spin polarization data it is possible to select the material for the container and the electrode by describing the influence of the wall surface on the nuclear spin polarization making use of the fractal dimension of the area with the same electron spin alignment. Since for its part the fractal dimension of the area with the same electron spin alignment has a connection with the material, it is possible to select optimum materials for the vessel. So far aluminum and iron-manganese materials have been found on the basis of such computation.

In order to make it possible for the fusion reactions to be induced in a suitable manner, the medium used for filling the fusion battery must have the following properties:

- An inclination to heavy phonon turbulence;
- a very high tunneling rate through the Coulomb wall in nuclear reactions;
- a possibility of adjustment to th desir d nuclear spin

polarization;

- compatibility with th material of the vessel wall; and
- a free path for the runaway protons and deuterons.

Materials with a strong inclination towards phonon turbulence are those in which the potentials for the nuclear motion are highly non-linear, because the nuclear motion is responsible for the phonon spectrum. Such highly non-linear potentials for the nuclear oscillations are for instance hydrogen bridge systems and more particularly these with double or multiple minimum potentials. Work so far has shown that hydrogen bridge systems are suitable for producing the desired phonon turbulence. Hydrogen bridge systems have the further advantage that the tunneling rate may be controlled by simple steps over a large range (several decades).

In order to ensure that the runaway protons and, respectively, deuterons may collide with a sufficiently high energy they have to tunnel through the Coulumb wall effectively and they must also move as far as the tunneling zone unbraked. Accordingly the path for the runaways has to be free of energy walls for a sufficient length of travel. Figures 4 to 10 show the potentials for two protons or, respectively, deuterons colliding together at a right angle. The broader the zero potential lane, the greater the probability of there being an effective fusion collision. As will be seen from figures 4 to 10, a suitable incident frequency is important, if the runaway nuclei are to be caused to collide with the least possible potential.

The requirements for the fusion medium may be summarized as follows:

- A high proportion of hydrogen bridges with double and multiple minimum potentials;
- such an adjustment of the degree of polymerization or chain length that the phonon turbulence reaches a maximum;
- fine adjustment of the nuclear spin polarization; and
- maximum width of lanes, in accordance with figures 4 to 10.

Claims:

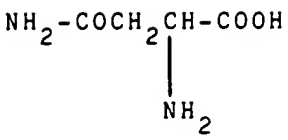
1. A method for producing a nuclear reaction or nuclear fusion using the tunnel effect, wherein the fusion medium consists of a deuterium-containing, non-crystallized polymer, which is conditioned with incident electromagnetic waves for a prolonged period of time, the incident frequencies being set at the tunnel eigenfrequencies of the unconditioned medium.

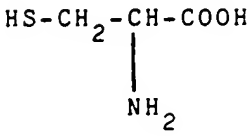
2. A method as claimed in claim 1, wherein the fusion medium is a deuterium-containing silicone or deuterium-containing polyamino acids.

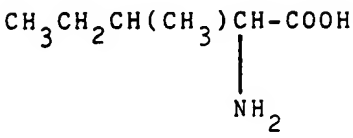
3. A method as claimed in claim 1 or 2, wherein the fusion medium contains a large proportion of hydrogen bridges with double or multiple potentials and the degree of polymerization, or more particularly the chain length, is so set that given a fine setting of the nuclear spin polarization to achieve broad tunnelling lanes the phonon turbulence reaches a maximum.

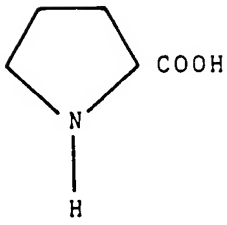
4. A method as claimed in any one of claims 1 to 3, wherein the fusion medium is a gel consisting of deuterium and the following amino acids:

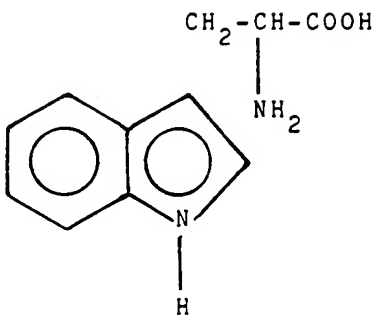
alanine (ala) $CH_3CH(NH_2)-COOH$

aparagine (asn) 

cystein (cys) 

isoleucine (ile) 

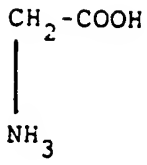
proline (pro) 

tryptophane (trp) 

with the amino acid sequence:

$[ile\text{-}ala\text{-}trp\text{-}pro\text{-}asp\text{-}cys\text{-}pro\text{-}ala\text{-}asn\text{-}pro]_n$

5. A method as claimed in any one of claims 1 to 3, wherein the fusion medium is a gel consisting of deuterium and the following amino acids:

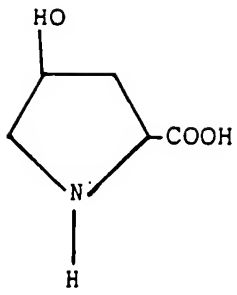
glycine (gly) 

aspargine (asu)

cystein (cys)

isoleucine (ile)

proline (pro)

hydroxyproline 

with the amino acid sequence:

$[gly\text{-}ala\text{-}hyp\text{-}pro\text{-}asp\text{-}cys\text{-}pro\text{-}hyp\text{-}asn\text{-}pro]_n$

6. A method as claimed in any one of the preceding claims, wherein the incident frequency is between 35 and 40 MHz or between 70 and 75 MHz.

7. A method as claimed in claim 6, wherein incident frequency is 36.5 MHz.

8. A method as claimed in any one of Claims 1 to 7, the unconditioned polymer is mixed with moderators.

9. A method as claimed in Claim 8, charact rized in that nickel salts are used as moderators, such as for example Ni $(CH_3\ COO)_2$; $NiSO_4$.

10. A method as claimed in Claim 8 or 9, characterized in that the concentration of the moderators is from 0.1 to 1.5% by weight of the entire polymer.

11. A method as claimed in any one of the preceding claims, wherein spurious frequency deviation is less than 10 Hz.

12. A method as claimed in any one of the preceding claims, characterized in that the phase of the incident radiation is kept constant.

13. A method as claimed in any one of the preceding claims, wherein the wavelength of the phonons amounts to approximately 53mm.

14. A method substantially as herein described with reference to the accompanying drawings.

15. Apparatus for performing the method as claimed in any one of the preceding claims, characterized by a fusion battery comprising a container and a centrally, coaxially placed electrode made of the same metal as the

container, a fusion medium arranged between the el ctrode and the container, an RF generator connected with the electrodes and a means connected between the container and the electrode in order to receive electricity therefrom.

16. Apparatus as claimed in claim 15, wherein the internal diameter of the fusion battery is determined generally by the wavelength of the phonons with a maximum degree of turbulence or a whole number multiple thereof and the length divided ((2n+1)/4); (wherein n = 0, 1, 2 ...) of the wavelength of the electromagnetic radiation in the fusion medium.

17. Apparatus as claimed in claim 15 or 16, wherein the container and the electrode are formed of aluminum or hydronalium.

18. Apparatus as claimed in claim 15 or 16, wherein the container and the electrode consist of an iron/manganese material.

19. Apparatus substantially as herein described with reference to the accompanying drawings.

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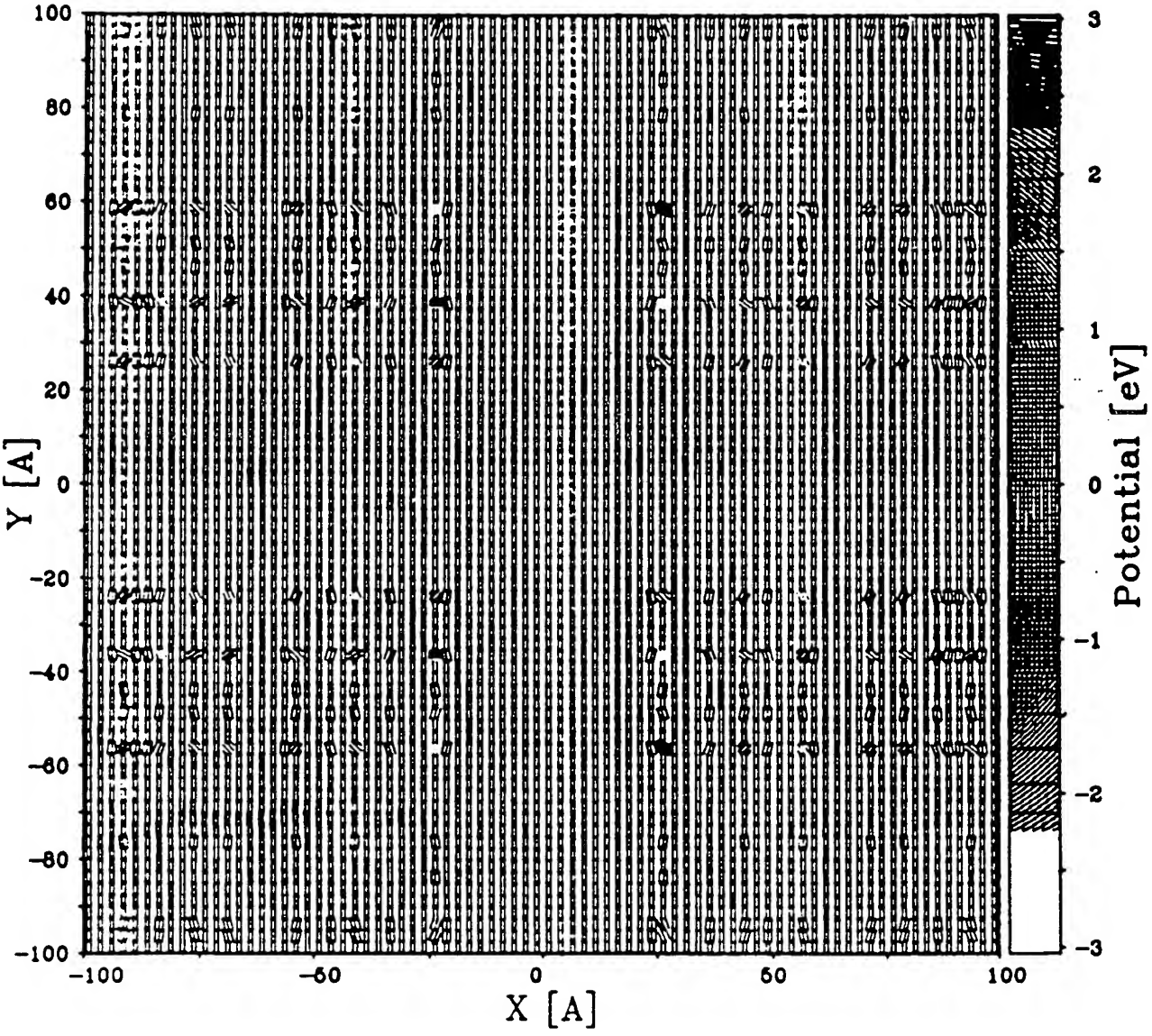
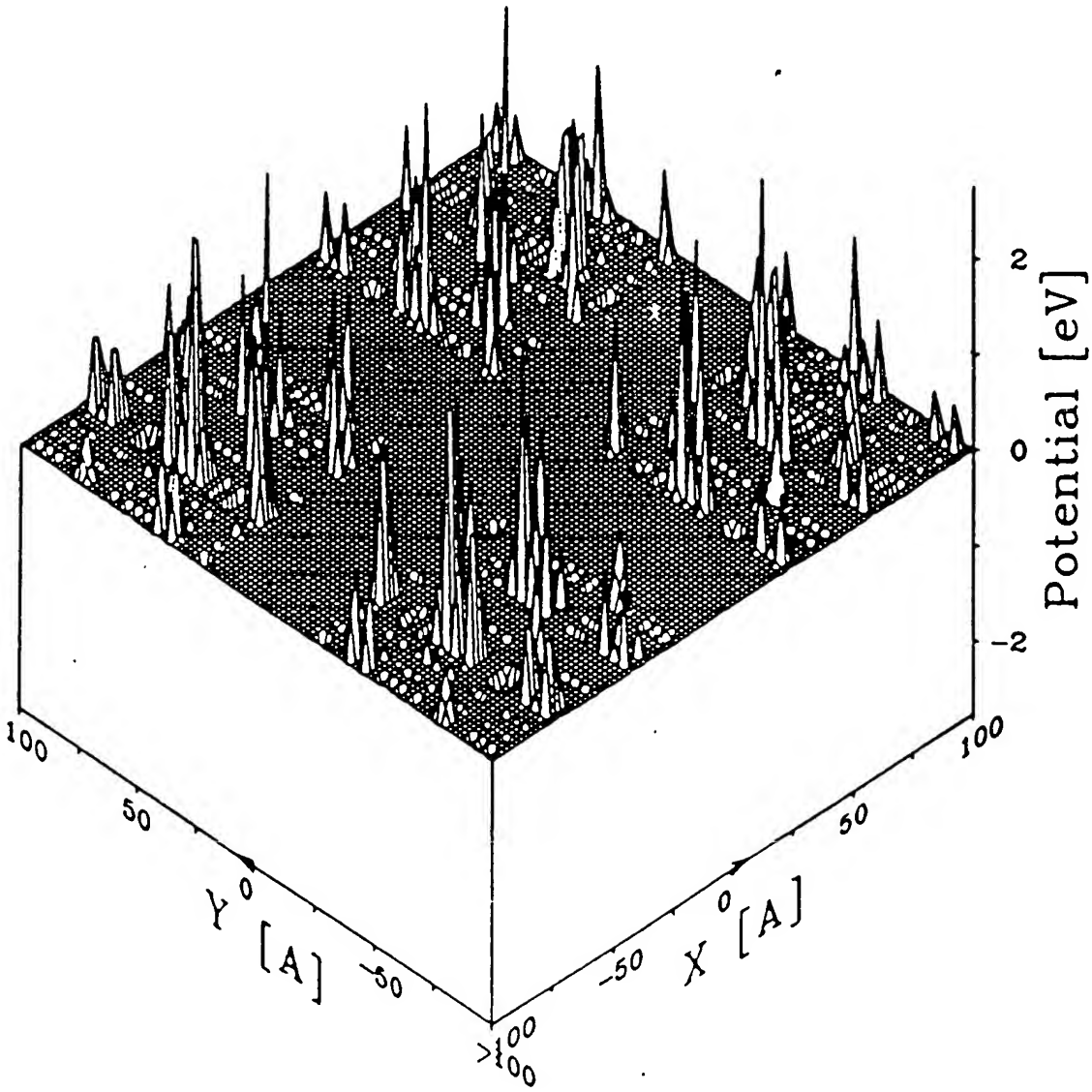


Quantum mechanical Potential of the
Outer surface of the Polymer
n=24, 36.5 MHz, T=19.1 Hours

1999-07-19
12:37:26
EGS(NOS/VE)
V. Eberl

ZMin=-3.032298365984 ZMax=3.032298365983

Fig.9.

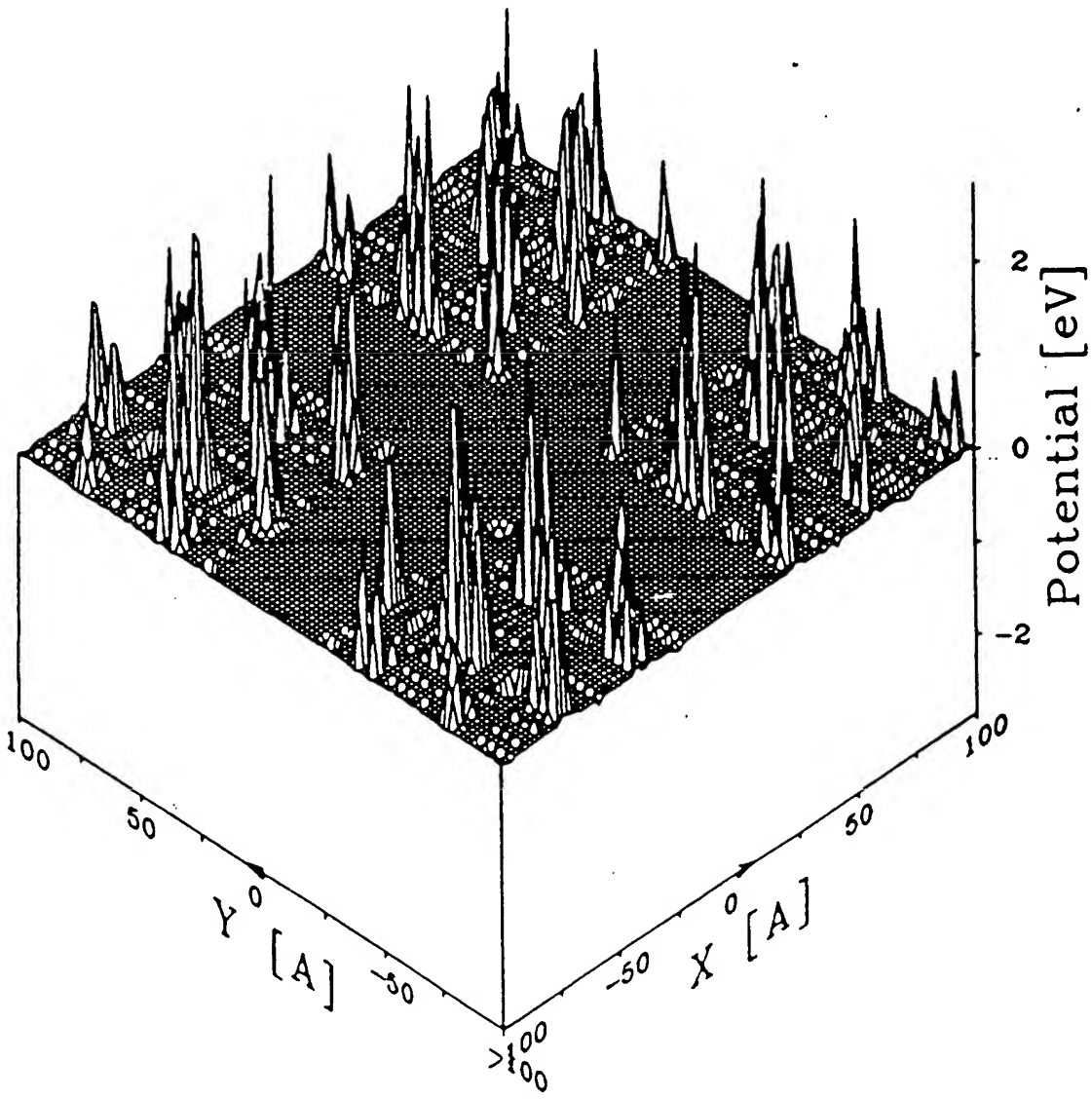


Quantum mechanical Potential of the
Outer surface of the Polymer
n=24, 36.5 MHz, T=19.1 Hours

1989-07-19
12:26:34
HCS(HOS/VE)
W. Eberl

ZMin=-2.760774475611 ZMax=2.760774475617

Fig.8.

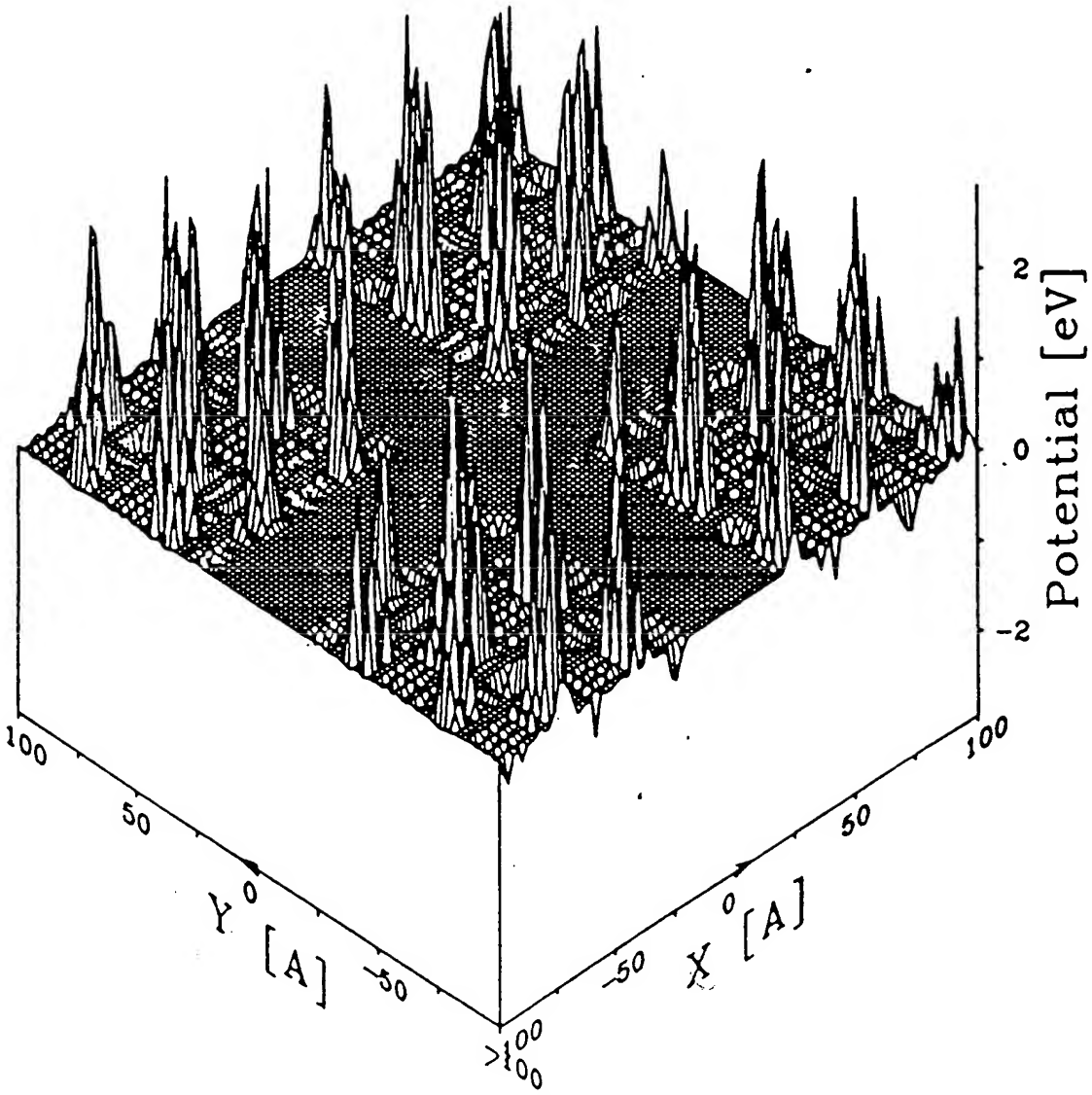


Quantum mechanical Potential of the
Outer surface of the Polymer
n=16, 36.5 MHz, T=10.4 Hours

1989-07-19
12:25:50
HCS(HCS/VE)
W. Eberl

ZMin=-2.840608472157 ZMax=2.840608472161

Fig.7.

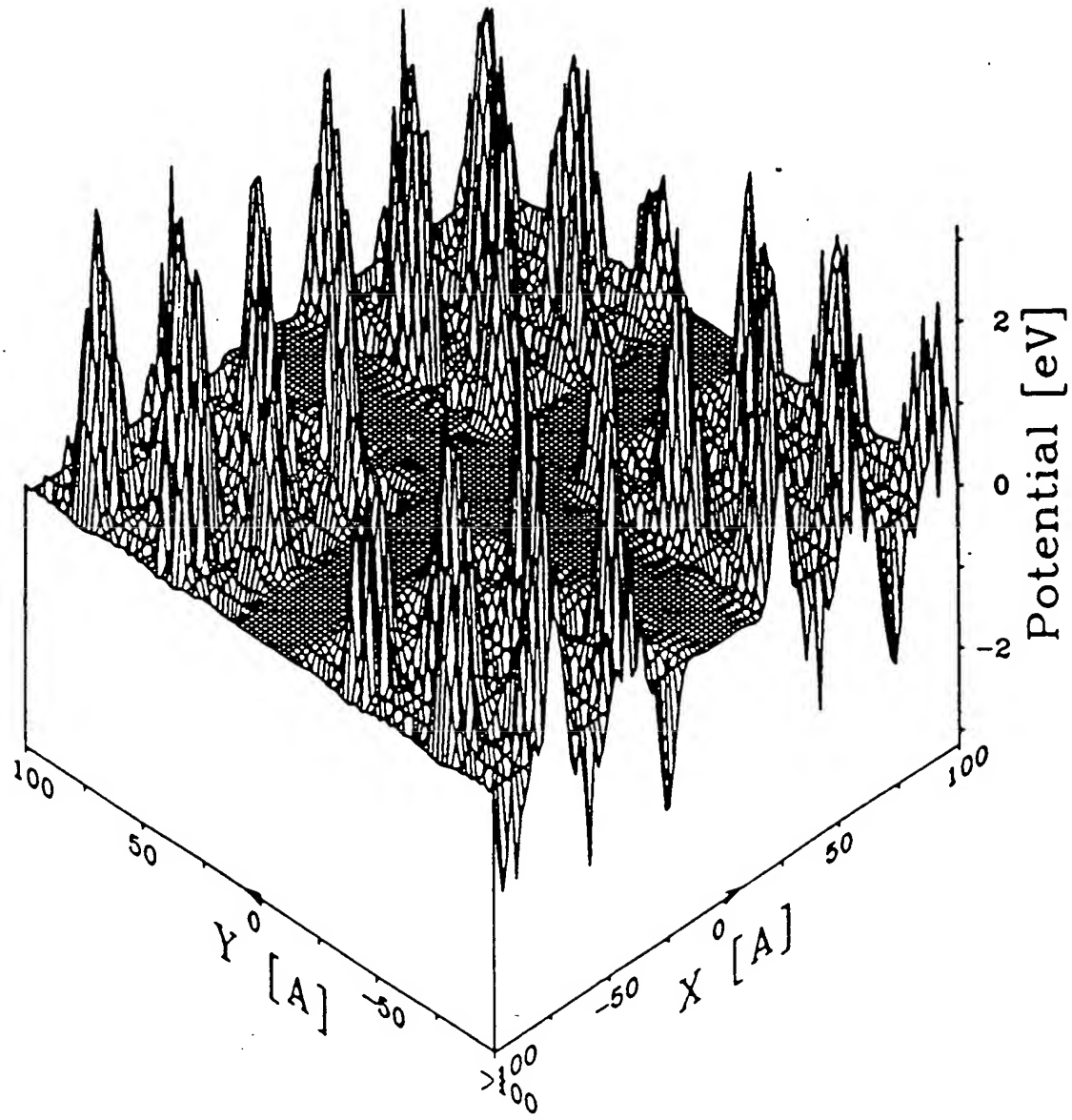


Quantum mechanical Potential of the
Outer surface of the Polymer
n=8, 36.5 MHz, T=1 Hours

1989-07-19
10:39:41
HGS(MOS/VE)
W. Eberl

ZMin=-2.922751048074 ZMax=2.922751048076

Fig.6.

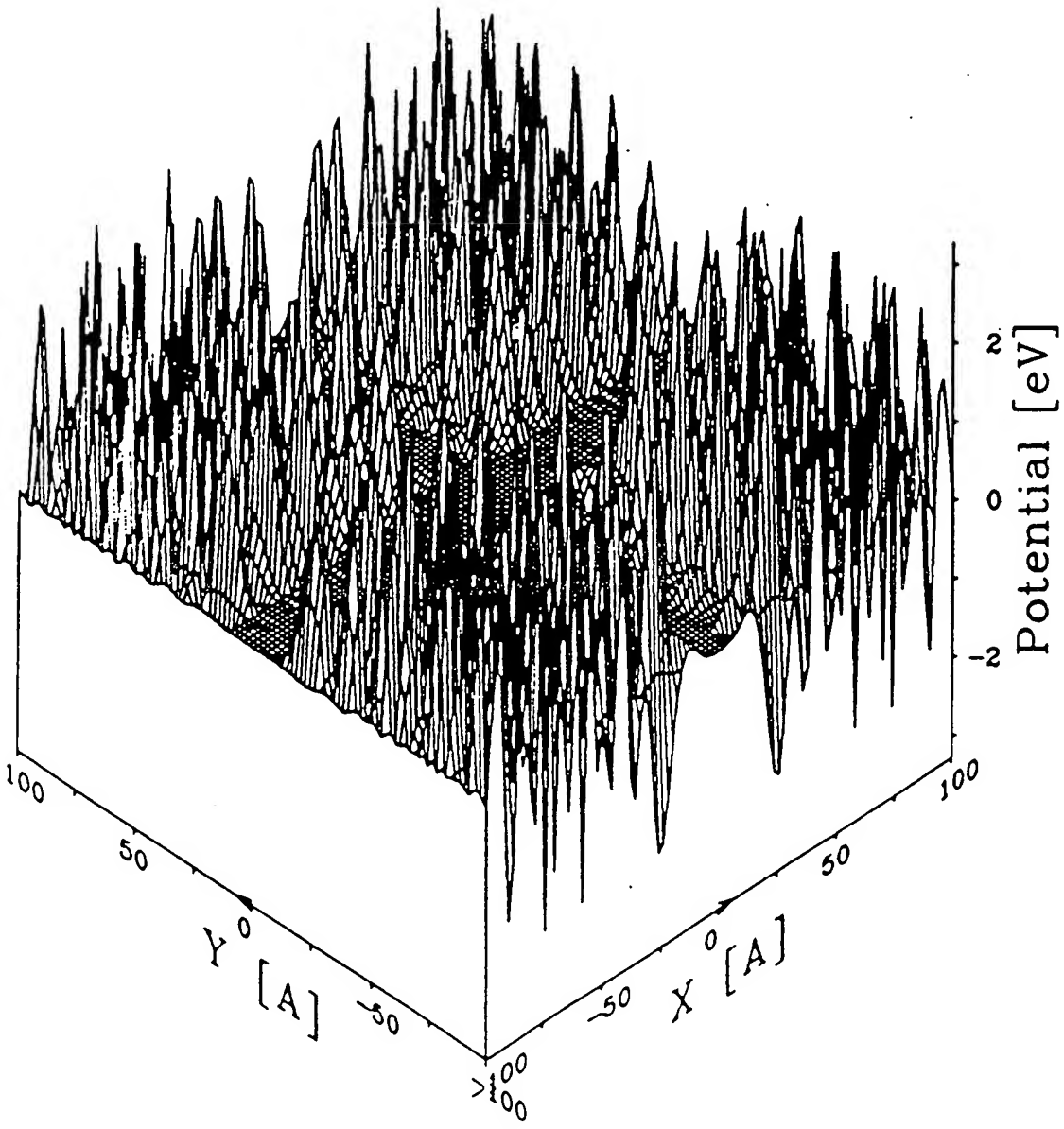


Quantum mechanical Potential of the
Outer surface of the Polymer
n=2, 35 MHz

1989-07-19
10:37:59
BCS(MOS/VE)
W. Eberl

ZMin=-3.169066730534 ZMax=3.169066730536

Fig.5.



Quantum mechanical Potential of the
Outer surface of the Polymer
n=1, 40 MHz

1989-07-19
10:34:38
HCS(HCS/VE)
W. Eberl

ZMin=-3.281887440231 ZMax=3.281887440231

Fig. 4.

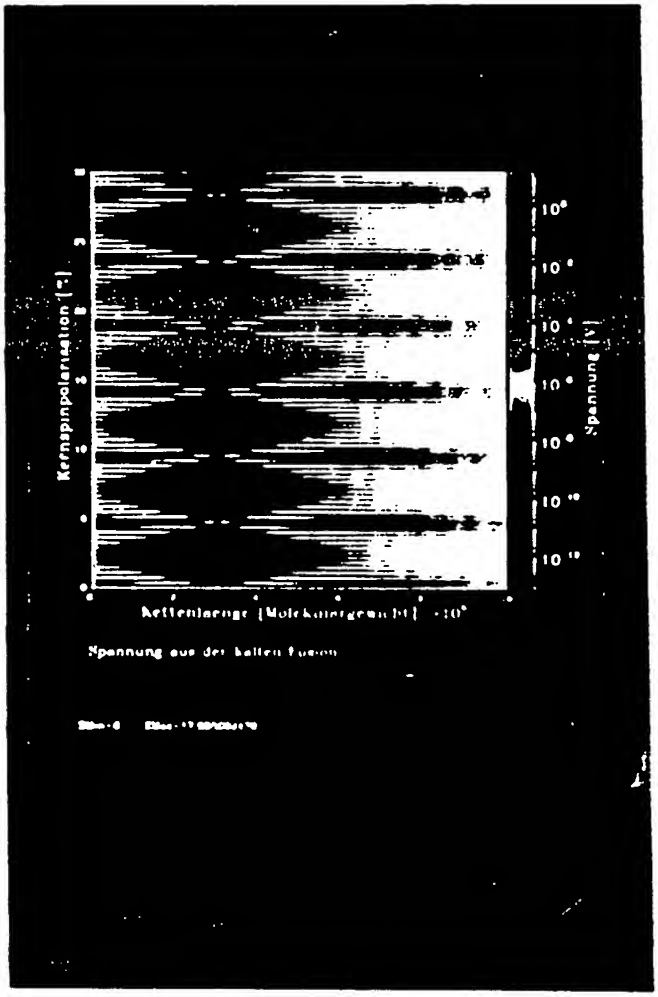

Kernspinpolarisation [-]
Spannung [V]
Kettenlaenge [Molekuelgewicht] *10^5
Spannung aus der kalten Fusion

Fig.3.

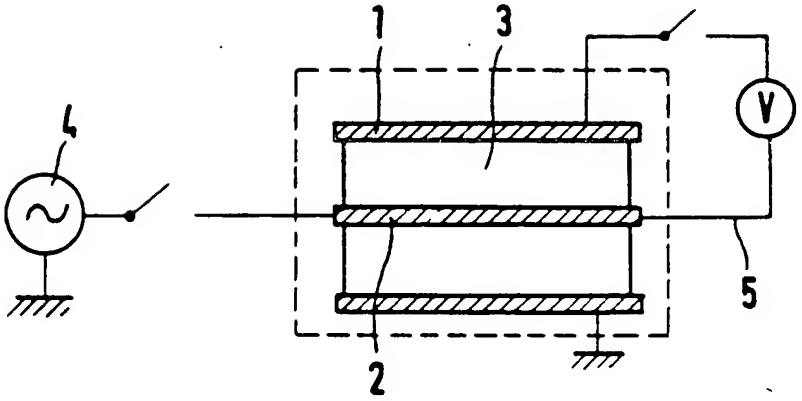


Fig.1.

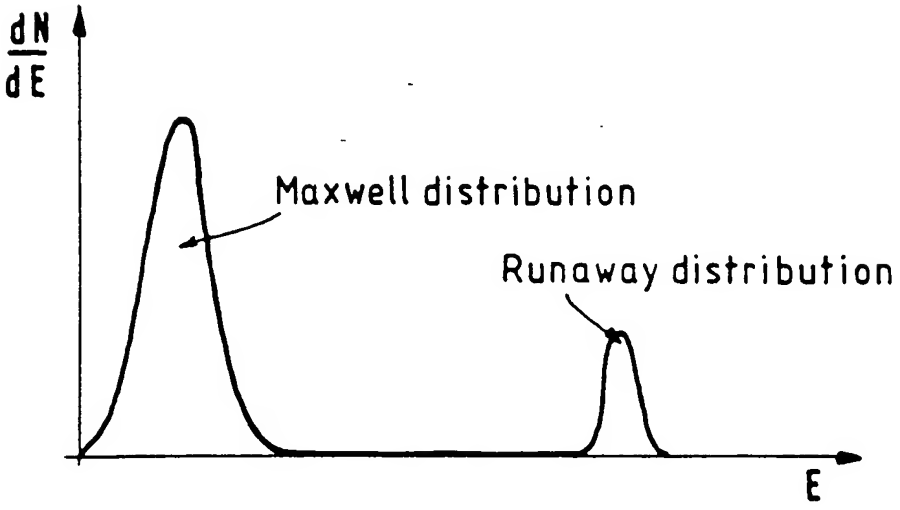


Fig.2.

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(21) Application No 9022653.1

(22) Date of filing 18.10.1990

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(51) INT CL[5]
G21B 1/00

(52) UK CL (Edition K)
G6P P3E4X

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None

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UK CL (Edition K) G6P
INT CL[5] G21B

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(54) A method and apparatus for the controlled initiation of nuclear reactions

(57) In a method for producing a nuclear reaction or a nuclear fusion the fusion medium consists of deuterium-containing, non-crystallized polymer, which is conditioned with incident electromagnetic waves for a prolonged period of time, the incident frequency being selected as the tunnel eigenfrequencies of the non-conditioned medium. This leads to operation as a fusion battery, consisting of a metallic container (1) and an electrode (2) of the same metal which is placed centrally and coaxially in the container (1) and with the fusion medium (3) therebetween. A means (5) for receiving current produced is arranged outside the container and connected electrically to the container (1) and the electrode (2).

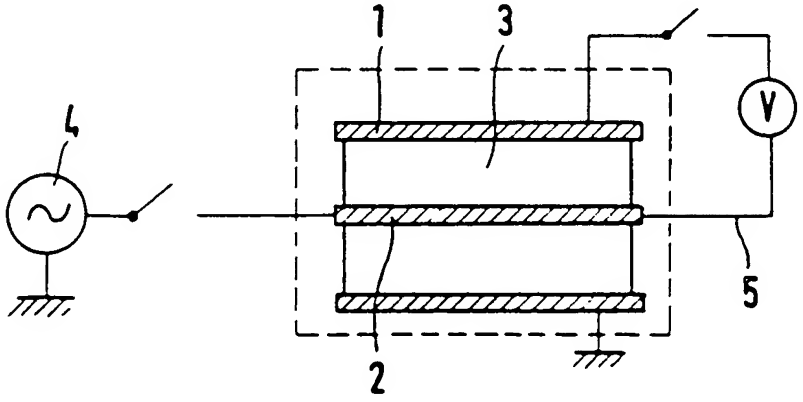

Fig.1.

GB 2 237 139 A